CURRICULUM VITAE

Name:	PROFESSOR SIR ALEXANDER FRED MARKHAM
Date of Birth:	30 November 1950
Place of Birth:	Ashton-under-Lyne, ENGLAND
Qualifications:	Scientific: BSc, PhD, DSc, CChem, FRSC, [HonDMedSci, HonDUniv, HonDSc]. Clinical: MBBS, FRCP, FRCPath, FMedSci, [HonDMed, HonDUniv, Kt].

Affiliations/Professional Experience

1968 - 1971	BSc in Chemistry, University of Birmingham.
1971 - 1974	PhD in Organic Chemistry, University of Birmingham. Supervisor: Professor A S Jones.
1992	DSc in Chemistry, University of Birmingham.
1974 - 1976	Royal Society Research Fellow, Osaka University, Japan, with Professor M Ikehara.
1976 - 1977	Cancer Research Campaign Research Fellow, Imperial College of Science and Technology, University of London, with Professor Sir Derek Barton FRS, NL.
1977 - 1979	G D Searle Pharmaceuticals, High Wycombe, Bucks.
1979 - 1990	ICI (now AstraZeneca) Pharmaceuticals/Diagnostics, Cheshire. Research Scientist/Group Leader/Research Manager/Medical Director, [Visiting Professor, St. Mary's Hospital Medical School, London].
1980 - 1986	St Mary's Hospital Medical School, University of London. MBBS [Foulkes Foundation Fellow].
1990 - 1992	Nuffield Department of Clinical Medicine, University of Oxford, John Radcliffe Hospital, Oxford, OX3 9DU.
1992 - Date	Professor of Medicine, University of Leeds. Hon Consultant Physician, Leeds Teaching Hospitals NHS Trust.
1992 - 2003	Director, Molecular Medicine Unit, University of Leeds.
2003 - 2007	Chief Executive, Cancer Research UK.
2007 - 2013	Senior Responsible Owner, NIHR Research Capability Programme.

Visiting Research

1978, 1979	MRC Laboratory of Molecular Biology, Cambridge, CB2 2QH. Collaboration with Drs R. Sheppard and M. J. Gait.
1982, 1984	Harvard University Medical School The Children's Hospital Medical Centre, Boston, MA 02115, USA. Collaboration with Professor S. H. Orkin.

Present Appointments

West Riding Professor of Medicine, University of Leeds.
Honorary Consultant Physician, Leeds Teaching Hospitals NHS Trust.

Senior Responsible Owner, NIHR Research Capability Programme.
Senior Medical Advisor, Cancer Research UK.
Chairman, Scientific Strategy Committee and Trustee, Arthritis Research UK.

Additional Information
General Medical Council Registration Number 3066166
Date of Full Registration: 11th August 1986.
Medical Insurance: Medical Defence Union 08/194929A
USA Medical Qualification: ECFMG Certification Number: 401-065-8

Fellow of the Royal College of Physicians, London.
Fellow of the Royal College of Pathologists.
Fellow of the Royal Society of Chemistry.
Fellow of the Academy of Medical Sciences.
Knight Batchelor, New Year Honours 2008.
Honorary Doctorates: Universities of Manchester, Leeds, Stirling, Keele and York.

Professional Societies

- Association of Physicians of Great Britain and Ireland
  (Honorary Membership, 2008; Osler Lecturer, 1995; Helen Rollason Lecturer, Association of Surgeons of Great Britain and Ireland, 2009)
- Association of Clinical Professors of Medicine
- Royal College of Physicians
- Royal College of Pathologists
- Royal Society of Chemistry
- American Society of Human Genetics
- American Association for Cancer Research
- American Society of Clinical Oncology
- British Society of Gastroenterology (Honorary Membership 2010)
- British Society of Human Genetics
- Academy of Medical Sciences (Forum Lecturer, 2004)

Current Administrative Responsibilities

UK Government

- Department of Health, Senior Responsible Owner and Board Chairman, NIHR/NHS Connecting for Health, Research Capability Programme, 2008-date.
- HEFCE, Chairman Clinical Medicine Research Excellence Framework (REF) Impact Pilot Panel, 2009-date.
- National Cancer Intelligence Network Steering Group Chairman, 2006-date.
- NIHR Senior Investigators Appointment Panel Member, 2007-2010; Chairman 2011-2014.
- Department of Health, Cancer Reform Strategy Advisory Board Member, 2007-date; Clinical Outcomes in Cancer Group Chairman, 2007-date.
- NHS National Information Reporting Service, Programme Board Member (with NHS Connecting for Health and the Information Centre for Health and Social Care), 2008-date.
- NHS Information Centre for Health and Social Care. General Practice Extraction Service Project Board Member, 2008-date.
- Department of Health/MHRA/ABPI, Ministerial Industry Strategy Group Advisory Panel Member, 2006-date.
- NCRI Informatics Initiative, Management Board Chairman, 2003-date.
- OSCHR Therapeutic Capability Clusters Delivery and Oversight Group Member, 2009-date.

Medical Research Council

- International Agency for Research on Cancer (World Health Organisation), UK-nominated Scientific Advisory Board Member, 2008-date.
- MRC Centre for Drug Safety Science, University of Liverpool, Scientific Advisory Board Member, 2009-date.

Other Organisations

- Chairman (elect), the Lister Institute of Preventive Medicine, 2010-date.
- BBSRC: The Genome Analysis Centre, Institute Board Chairman, 2010-date.
- Oxford University Cancer Centre, Board Chairman, 2010-date.
- German Consortium for Translational Cancer Research of the Federal Ministry of Education and Research, Review Panel Member, 2010-date.
- The Oak Foundation (Geneva), Medical Advisory Board Member, 2010-date.
- Arthritis Research UK, Chairman Scientific Strategy Committee and Trustee, 2009-date.
- Sir Jules Thorn Medical Research Trust International Autozygosity Mapping Resource, Steering Group Chairman, 2009-date.
- Academy of Medical Sciences, Clinical Academic Careers Committee Member, 2008-date.
- Deutsche Krebshilfe Program for the Development of Interdisciplinary Oncology Centers of Excellence in Germany, Clinical Advisory Board Member, 2008-date.
- Singapore Government Agency for Science, Technology and Research (A-STAR) Board Member, 2007-date.
- A-STAR Biomedical Research Council Board Member, 2007-date.
- International Union Against Cancer (UICC), Member of the Board of Directors, 2006-date.
- Vice President "QUIT ", the 'Stop Smoking' charity, 2004-date.
- Governor, Bradford Grammar School, Yorkshire, 2008-date.
- Foulkes Foundation Scientific Advisory Board Member, 1992-2007; Trustee, 2007-date.
- Daniel Turnberg Trust Panel Member, Academy of Medical Sciences, 2008-date.
- Trustee, Candlelighter's Trust, Yorkshire Children's Cancer Charity, 1993-date.
- International Advisory Board Member, School of Medicine, Dentistry and Biomedical Sciences, Queen's University Belfast, 2008-date.

Previous Administrative Responsibilities

UK Government

- Office for the Strategic Co-ordination of Health Research (OSCHR), Translational Medicine Board Chairman. H.M. Treasury, Departments of Health / Innovation, Universities and Skills, 2007- 2010.
- Department of Health, National Programme for Information Technology (NPfIT) Board Member, 2007-2010.
- UK Clinical Research Collaboration Board Member, 2004-2007.
- National Institute for Health Research Advisory Board Member, 2006-2007.
- Department of Innovation, Universities and Skills, Government Office for Science; Science Review of the Department of Health, Steering Panel Member, 2007-2008.
- Department of Health, Expert Scientific Group on Phase 1 Clinical Trials, Member 2006. [The Northwick Park Enquiry].
- Department of Health, Ministerial Advisory Group on the Operation of NHS Research Ethics Committees, Member, 2004-2005. [Lord Warner Report].
- Department of Health/HEFCE, National Clinician Scientist Awards Panel Chairman,
- 2001-2003.
- Department of Health, Gene Therapy Advisory Committee Member, 2000-2006.
- MHRA, Committee on Safety of Medicines, Biologicals Sub-Committee, 2002-2006.
- Department of Health, Advisory Group for Genetics Research, 2003-2007.
- EPSRC Metrology for Life Sciences, Assessment Panel Member, 2000-2004.
- EPSRC Engineering Responsive Mode Advisory Panel for Healthcare, Member, 2002-2004.
- Office of Science and Technology, Technology Foresight Programme: Health and Life Sciences Sector Panel Member, 1994-96 and 1999-2000.
- NHS Central Research and Development Committee (CRDC), Standing Group on Health Technology: Population Screening Advisory Panel Member, 1994-2003.
- NHS Central Research and Development Committee (CRDC), National Expert Advisory Group on Genetics Member, 1993-95.
- Department of Health, Advisory Committee on Dangerous Pathogens ad hoc Committee on Gene Therapy, 1997.
- Northern and Yorkshire Regional Health Authority, Biomedical Research Working Group
- Member, 1995-98.
- Yorkshire Regional Health Authority Locally Organised Research Scheme and Clinical Advances Fund Programme, Expert Working Group Member, 1993-95.

Medical Research Council

- MRC Interim Strategy and Planning Group Member, 2007.
- MRC Training and Career Development Board Member, 2000-2003.
- MRC Clinical Training and Career Development Panel Chairman, 1999-2002.
- MRC Clinical Training and Career Development Panel Member, 1994-1998.
- MRC Scientific Advisory Committee Member, 1997–2003.
- MRC Molecular and Cellular Medicine Board Grants Committee B Member, 1993-1997.
- MRC Special Training Fellowships Panel for Health Services Research Member, 1995-1997.
- MRC "Realising Our Potential Awards" (ROPA) Panel Member, 1995-1997.

- MRC/Wellcome Human Embryo Banking/Human Developmental Biology Resource Working Party Chairman, 1996–2003.
- MRC Animal Embryo Banking Working Party Chairman, 1996-2002.
- MRC/ECACC Cell Bank Working Party Member, 1996-2003.
- MRC Joint Research Equipment Initiative Panel Member, 1998. Chairman, 1999–2003.
- MRC ALSPAC Co-operative Group Member, 1999–2004.
- MRC Advisory Committee on 'Scientific Advances in Genetics (ACSAG) which impact on the Health Service & Society' Member, 2000-2003.
- MRC National Stem Cell Bank Advisory Committee Member, 2001-2003.
- MRC "Clinical Applications of Advances in Human Genetics" Co-operative Group, Principal Investigator, 2001-2006.
- MRC Programme Grant, Principal Investigator, 1994-1999.
- MRC Pre-Doctoral Fellowships Panel Chairman, 2002-2004.
- MRC/BBSRC/AMRC Stem Cell Fellowships Panel Chairman, 2003–2005.

Wellcome Trust

- Wellcome Trust Molecular and Cell Panel Chairman, 2003.
- Wellcome Trust Molecular and Cell Panel Member, 2000-2002, Deputy Chairman 2002-03.
- Wellcome Trust Equipment Working Party Member, 1996-1999.
- Wellcome Trust Infrastructure Panel Member, 1997-1999.
- Wellcome Trust/Health Research Board Republic of Ireland, "New Blood" Fellowships in Medical Science Panel Chairman, 1998-2002.
- Wellcome Trust/Irish Health Research Board, Equipment Awards Panel Member, 2000–2003.
- Wellcome Trust Innovation Awards Committee Member, 1998-2002.
- Wellcome Trust/Joint Infrastructure Fund, "Leeds Centre for Biomolecular Interactions", Investigator 2001-2006.
- Wellcome Trust/Strategic Research Infrastructure Fund, "Leeds Institute of Molecular Medicine", Principal Applicant, 2001-2006.

Other Organisations

- Chief Executive, Cancer Research UK, 2003-2007.
- National Cancer Research Institute Chairman, 2003-2006, Board Member 2006-2008.
- Cancer Research UK Clinical Training Panel Chairman, 2007-2009.
- Cancer Research UK Scientific Strategy Advisory Group Chair/Member, 2003-2009.
- American Association for Cancer Research, International Affairs Committee Member,
- 2004-2009.
- Li Ka Shing Institute of Health Sciences at the Chinese University of Hong Kong, Steering Committee Member, 2007-2010.
- Scientific Advisory Board Member, Weatherall Institute of Molecular Medicine, Oxford, 1999-2009.
- International Advisory Committee Member, Conway Institute of Biomolecular and Biomedical
- Research, University and Trinity Colleges Dublin, and Royal College of Surgeons of Ireland, 2001-2004.

- International Advisory Board Member, BBSRC/MRC/EPSRC UK Centre for Tissue Engineering, Manchester/Liverpool, 2001-2004.
- Manchester Comprehensive Cancer Research Centre Board Member, 2005-2007.
- University of Sheffield Cancer Research Advisory Board Chair, 2008-2009.
- Quarterly Journal of Medicine, Editorial Board Member 1995-2008.
- Institute for Cancer Research, London. Trustee, 2003-2005.
- Clatterbridge Hospital Liverpool Scientific Advisory Committee Member, 1994-2003.
- ALSPAC (Avon Longitudinal Study of Pregnancy and Childhood) Genetics Advisory Committee Member, 1996-2001.
- Scientific Advisory Committee Member, Yorkshire Cancer Research Campaign, 1993-2000.
- Scientific Advisory Committee Member, Northwest Cancer Research Charity, 1999-2001.
- Research and Development Director, St James's University Hospital NHS Trust, 1995-1997.
- University of Leeds: School of Medicine Research Dean; School of Medicine Executive Board Member, 1998-2001; Head of Department, 1993–2003; Member of Court, 2003-2005; Member of Senate, 2003-2005.
- Examiner: Royal College of Pathologists; MBBS and BMedSci, University of Oxford; University of London; University College, Dublin ; PhD to most UK Universities.
- Grant Peer Reviewer for all major Medical Research Charities. Association of Medical Research Charities Board, 2003-2007.

Commercial Experience

- 14 years' experience as a Research Scientist/Team Leader/Clinician/Research Manager in GD Searle Pharmaceuticals, then ICI (now AstraZeneca) Pharmaceuticals and Diagnostics. Line and project management responsibilities for multiple groups of 50 plus R&D scientists and clinicians, in pharmaceutical and diagnostics businesses in a number of disease areas, including USA commercial and scientific management experience. Broad experience in patenting/intellectual property matters. Numerous granted patents.

- Executive responsibilities for an ICI (now AstraZeneca) Business Unit. Internal Medical Director role. Experience in identification and evaluation of companies for acquisition or joint-venturing as a member of cross-functional negotiating teams.

- Products developed: Zeneca/Cellmark Diagnostics' DNA Fingerprinting and Genetic Testing business worldwide. Appointed by the Home Secretary under the Family Law Reform Act, 1969, as a Registered Blood Tester for DNA Fingerprinting. Queen's Award for Technological Achievement 1990. Inventor of the "ARMS" technology for diagnostic genetic testing, commercialised by the AZ spin-off company DxS, which was recently sold for ca £100million. Member of the Development Teams for the drugs Raltitrexed (Tomudex), Bicalutamide (Casodex), Anastrozole (Arimidex) and Fulvestrant (Faslodex). As Programme Manager 1989-1991 established the AstraZeneca research group which developed the anticancer drug Gefitinib (Iressa).

- Director and Chief Executive (1995-2002) of a University of Leeds Biotechnology Start-Up Company, Molecular Solutions Limited. Lead business through two rounds of financing.

- Scientific Advisory Board Member, Oxagen plc 1998-2004.

- Bioscience Venture Capital Trust, Board Director 1998-2004 (one of few VCTs to generate a substantial increase in NPV).

- As Chief Executive of Cancer Research UK, completed the merger of the Charity and built an organisation that doubled its annual income over 4 years (ca £230 to £460 million) to create the world's largest fundraising medical research charity. Defined CR-UK's long term Strategy and Goals. Reorganised the Beatson, Gray and Paterson Institutes, built the Cambridge Research Institute and repositioned the London Research Institute. Substantially expanded CR-UK's translational research activities with the NIHR to take 20 new agents into patients each year, through a national network of Experimental Cancer Medicine Centres, with CR-UK Cancer Research Centres for later stage clinical studies. As Chair of the NCRI and through the UKCRC Board, supported the creation of NIHR National Clinical Research Networks, led the lobbying for the 2006 UK-wide Ban on Smoking in Public Places and the National Bowel Cancer Screening Programme, and worked with the National Cancer Director to deliver the 2007 Cancer Reform Strategy.

- Scientific Advisory Board, Roche Pharmaceuticals, 2007-2010.

- Scientific Advisory Board, GSK Clinical Imaging Centre, London, 2010-date.

GENERAL REFEREES

Professor Sir Alan G. Wilson FRS,
Vice-Chancellor (retired),
University of Leeds,
Leeds, LS2 9JT

Professor Sir Alec J. Jeffreys FRS,
Department of Genetics, University of Leicester
Leicester, LE1 7RH

Sir Tom F. W. McKillop,
Chief Executive (retired), AstraZeneca Pharmaceuticals,
Alderley Park, Macclesfield, Cheshire, SK10 4TG

Professor Steven V. Ley FRS,
University Chemical Laboratory, University of Cambridge
Lensfield Road, Cambridge, CB2 1EW

Sir Alan Langlands,
Chief Executive, Higher Education Funding Council for England,
Centre Point, 103 New Oxford Street, London, WC1A 1DD.

Professor Dame Nancy Rothwell FRS,
President and Vice Chancellor, University of Manchester,
A. V. Hill Building, Oxford Road, Manchester, M13 9PT.

CLINICAL REFEREES

Professor Sir David Weatherall FRCP FRS,
Regius Professor of Clinical Medicine (retired),
University of Oxford,
John Radcliffe Hospital, Oxford, OX3 9DU

Professor Dame Sally Davies
Director General, Research and Development,
Interim Chief Medical Officer, Department of Health,
Richmond House, 79 Whitehall, London SW1A 2NS.

Professor Sir John Bell FRS PMedSci,
Regius Professor of Clinical Medicine,
University of Oxford, Richard Doll Building,
Churchill Hospital, Roosevelt Drive, Headington, Oxford, OX3 7DG.

Professor Sir David Carter FRCS, FRSE, FMedSci,
Emeritus Professor of Surgery, University of Edinburgh,
Cancer Research UK,
61 Lincoln's Inn Fields, London WC2A 3PX

Professor Bert Vogelstein,
The Johns Hopkins Oncology Center,
424 North Bond Street,
Baltimore, MD21231, USA

Professor Stuart H. Orkin,
Harvard University Medical School,
The Children's Hospital Medical Centre,
300 Longwood Avenue,
Boston, MA02115, USA

Professor Sir Michael Richards CBE, FRCP, FMedSci,
National Cancer Director, Department of Palliative Medicine,
St Thomas' Hospital, London SE1 7EH.

Peer-Reviewed Research Grant Income

- **Previous Awards available as an Appendix.**
- **Current Awards**:

EPSRC. *Engineering Therapeutic Microbubbles*. £1.3m. 2010-2013.
S Evans (PI), AF Markham, PL Coletta, S Freear, JA Evans, R Bushby, N Thomson and PF Jones.

Cancer Research UK. *Novel Approaches to Cancer Therapeutics*. £500,000. 2008-2016.
AF Markham (PI).

PhD Students (non-clinical)

R.A. Porter	Imperial College London	1981
W.M. Colledge	N.I.M.R. London (CNAA)	1984
C.R. Newton	Brunel University	1986
A. Bailey	Leeds University	1996
S. E. Anderson	" "	1996
A. Norris	" "	1997
J. M. Askham	" "	1997
H. C. Ardley	" "	1997
D. A. Robinson	" "	1997
J. P. Leek	" "	1998
I.M. Carr	" "	1998
M.A. Calderwood	" "	1998
F. Syed	" "	1998
K. Pinchin	" "	1999
D. Goodwin	" "	1999
N. R. Smith	" "	2000
A. Middleton	" "	2000
E. Barnes	" "	2000
M. Houseman	" "	2001
S. Gonagle	" "	2001
W.K. Lam	" "	2002
L. M. Moynihan	" "	2002
C. Lynex	" "	2003
G. Marston	" "	(2011)

PhD Students (Clinical Research Training Fellows)

R. Harun	Leeds University	1997
A.J. Churchill	" "	1998
A.H. Mansur	" "	1998
N.S. Brindle	" "	1999
A.P. Booth	" "	1999
M.A. Aldersley	" "	1999
K.A. Southern	" "	1999
D.P. McHale	" "	2000
R.C.A. Macadam	" "	2000
A.P. Jackson	" "	2000
B.H. Maraj	" "	2000
J.P. Hamlin	" "	2001
Y.J. Crow	" "	2001
A.R. Craig	" "	2001
M. Karayi (MD)	" "	2001
R. Achuthan	" "	2001
E. S. Ward	" "	2002
K.S. Chapple	" "	2002
A.W. Morgan	" "	2002
P. Moncur	" "	2002
M.S. Giles	" "	2003
P. Komolmit	" "	2003
F.T. Leong	" "	2003
B.S. Ubhi	" "	2004
G.A. Follows	" "	2004
T. Lee	" "	2005
S Uppal	" "	2010
N Touqan	" "	(2013)

PUBLICATIONS

1. A Simple Method for the Preparation of "Ribonucleoside Dialdehydes" and Comments on their Structure.
A. S. Jones, A. F. Markham and R. T. Walker.
J. Chem. Soc. Perkin 1, 1567-1570 (1976).

2. The Synthesis of Poly (Acrylic Acid Hydrazide) with Poly (Methacrylic Acid Hydrazide) and their Reaction Products with "Ribonucleoside Dialdehydes".
A.S. Jones, A. F. Markham and R. T. Walker.
Tetrahedron, 32, 2361-2364 (1976).

3. Synthesis of *E. coli* $tRNAf^{met}$ Fragments.
E. Ohtsuka, A. F. Markham, S. Tanaka, T. Tanaka, T. Miyake, E. Nakagawa, S. Nishikawa and M. Ikehara.
Nucleic Acids Research, 2, 77-81 (1976).

4. Recent Progress in the Synthesis of Ribooligonucleotides Related to tRNA.
E. Ohtsuka, A. F. Markham, S. Nishikawa, S. Tanaka, T. Tanaka, T. Miyake, E. Nakagawa and M. Ikehara.
in "Synthesis, Structure and Chemistry of Transfer Ribonucleic Acids",
M. Wiewiorowski ed, Polish Academy of Sciences, Poznan, pp 173-185 (1976).

5. An Approach to the Synthesis of Intermediate Sized Oligoribonucleotides.
A. F. Markham, T. Miyake, E. Ohtsuka and M. Ikehara.
Heterocycles, 8, 229-233 (1977).

6. Joining of Synthetic Ribotrinucleotides with Defined Sequences Catalysed by T4 RNA Ligase.
E. Ohtsuka, S. Nishikawa, R. Fukumoto, S. Tanaka, A. F. Markham, M. Ikehara and M. Sugiura.
Eur. J. Biochem., 81, 285-291 (1977).

7. Synthesis of Escherichia coli $tRNAf^{met}$ fragments (1-20, 47-77).
E. Ohtsuka, T. Tanaka, S. Tanaka, A. F. Markham, T. Miyake, E. Nakagawa, S. Nishikawa and M. Ikehara.
Nucleic Acids Research, 3, 117-121 (1977).

8. Studies on tRNA and Related Compounds XXI. Synthesis and Properties of Guanine Rich Fragments from *E. coli* $tRNAf^{met}$ 5'-end.
E. Ohtsuka, E. Nakagawa, T. Tanaka, A. F. Markham and M. Ikehara.
Chem. Pharm. Bull., 26, 2998-3006 (1978).

9. Joining of 3'-Modified Oligonucleotides by T4 RNA Ligase. Synthesis of a Heptadecanucleotide Corresponding to the bases 61-77 from *E. coli* $tRNAf^{met}$.
E. Ohtsuka, S. Nishikawa, A. F. Markham, S. Tanaka, T. Miyake, T. Wakabayashi, M. Ikehara and M. Sugiura.
Biochemistry, 17, 4894-4899 (1978).

10. The Synthesis of Polynucleotides.
M. Ikehara, E. Ohtsuka and A. F. Markham.
in "Advances in Carbohydrate Chemistry and Biochemistry", R S Tipton and D Horton eds, Academic Press, New York, Vol 36, pp 135-213 (1979).

11. Influence of Terminal 3'-Phosphates or 2', 3'-Cyclic Phosphates on the Conformations of Oligoriboadenylates, Oligoribocytidylates and the Corresponding Monomers.
A. F. Markham, S. Uesugi, E. Ohtsuka and M. Ikehara.
Biochemistry, 18, 4936-4942 (1979).

12. Studies on tRNA and Related Compounds XXVII. Linear and Cyclic Oligonucleotides Obtained by Polymerisation of Protected Ribonucleoside 3'-Phosphates.
A. F. Markham, E. Nakagawa, E. Ohtsuka and M. Ikehara.
Chem. Pharm. Bull., 27, 2988-2996 (1979).

13. Rapid Chemical Synthesis and Circular Dichroism Properties of Some 2'-5'-linked Oligoriboadenylates.
A. F. Markham, R. A. Porter, M. J. Gait, R. C. Sheppard and I. M. Kerr.
Nucleic Acids Research, 6, 2569-2582 (1979).

14. Synthesis of the Nascent Strand of $tRNAf^{met}$ from *E. coli*.
E. Ohtsuka, T. Tanaka, S. Tanaka, K. Fujiyama, A. F. Markham, E. Nakagawa, T. Wakabayashi, Y. Taniyama, S. Nishikawa, R. Fukumoto, H. Uemura, T. Doi and M. Ikehara.
Nucleic Acids Research, 6, 195-198 (1979).

15. Synthesis of Total Fragments of $tRNAf^{met}$ from *E. coli*.
E. Ohtsuka, S. Tanaka, S. Nishikawa, T. Miyake, T.Tanaka, E. Nakagawa, T. Wakabayashi, A. F. Markham, J. Antkowiak and M. Ikehara.
in "Nucleosides, Nucleotides and their Biological Applications", J-L Barascut and J-L Imbach eds, Colloq de l'INSERM, 81, 195-206 (1979).

16. Studies on tRNA and Related Compounds XXVI. Circular Dichroism Properties of Cyclic Oligoribonucleotides and their Linear Conterparts.
A. F. Markham, E. Nakagawa, E. Ohtsuka and M. Ikehara.
Biopolymers, 19, 285-296 (1980).

17. Studies on tRNA and Related Compounds XXXIV. Stepwise Diester or Partial Triester Synthesis of Penta- to Octanucleotides Corresponding to Residues 41-46, 47-54, 61-65 and 66-71 of $tRNAf^{met}$ of *E. coli*.
E. Ohtsuka, T. Miyake, A. F. Markham, E. Nakagawa and M. Ikehara.
Chem. Pharm. Bull., 28, 2450-2459 (1980).

18. Synthesis of $tRNAf^{met}$ from *E. coli*.
M. Ikehara, E. Ohtsuka, S. Tanaka, S. Nishikawa, T. Tanaka, T. Miyake, E.Nakagawa, T. Wakabayashi, R. Fukumoto, H. Uemura, Y. Taniyama, T. Doi, A. F. Markham and J. Antkowiak.
in "Phosphorus Chemistry Directed Towards Biology", W. J. Stec ed, Pergamon Press, New York, pp 33-45 (1980).

19. Rapid Synthesis of Oligodeoxyribonucleotides IV. Improved Solid Phase Synthesis of Oligodeoxyribonucleotides through Phosphotriester Intermediates.
M. J. Gait, M. Singh, R. C. Sheppard, M. D. Edge, A. R. Greene, G. R. Heathcliffe, T. C. Atkinson, C. R. Newton and A. F. Markham.
Nucleic Acids Research, 8, 1081-1096 (1980).

20. Total Synthesis of $tRNA_f^{met}$.
E. Ohtsuka, A. F. Markham, S. Tanaka, T. Tanaka, T. Miyake, E. Nakagawa, T. Wakabayashi, Y. Taniyama, K. Fujiyama, S. Nishikawa, R. Fukumoto, H. Uemura, T. Doi, T. Tokunaga and M. Ikehara.
Nucleic Acids Research, 7, 335-343 (1980).

21. Solid Phase Phosphotriester Synthesis of Large Oligodeoxyribonucleotides on a Polyamide Support.
A. F. Markham, M. D. Edge, T. C. Atkinson, A. R. Greene, G. R. Heathcliffe, C. R. Newton and D. B. Scanlon.
Nucleic Acids Research, 8, 5193-5205 (1980).

22. Total Synthesis of a Human Leukocyte Interferon Gene.
M. D. Edge, A. R. Greene, G. R. Heathcliffe, P. A. Meacock, W. Schuch, D. B. Scanlon, T. C. Atkinson, C. R. Newton and A. F. Markham.
Nature, 292, 756-762 (1981).

23. Total Synthesis of a RNA Molecule with sequence identical to that of *Escherichia coli* formylmethionine tRNA..
E. Ohtsuka, S. Tanaka, T. Tanaka, T. Miyake, A. F. Markham, E. Nakagawa, T. Wakabayashi, Y. Taniyama, S. Nishikawa, R. Fukumoto, H. Uemura, T. Doi, T. Tokunaga and M. Ikehara.
Proc. Natl. Acad. Sci. USA, 78, 5493-5497 (1981).

24. Applications of Oligonucleotide Synthesis to Interferon Research.
M. D. Edge and A. F. Markham.
Biochim. Biophys. Acta Reviews on Cancer, 695, 35-48 (1982).

25. Isolation of cDNA clones for the Human complement protein Factor B, a class III major histocompatibility complex gene product.
D. E. Woods, A. F. Markham, A. T. Ricker, G. Goldberger and H. R. Colten.
Proc. Natl. Acad. Sci. USA, 79, 5661-5665 (1982).

26. Synthesis of some 5'-Amino-2' , 5'-Dideoxy-5-Iodouridine Derivatives and their Antiviral Properties against Herpes Simplex Virus.
A.F. Markham, C.R. Newton, R.A. Porter and I.S.Sim.
Antiviral Research, 2, 319-330 (1982).

27. The construction of a synthetic *Escherichia coli Trp* promoter and its use in the expression of a synthetic interferon gene.
J.D. Windass, C.R. Newton, J. de Maeyer-Guignard, V.E. Moore, A.F. Markham and M.D. Edge.
Nucleic Acids Research, 10, 6639-6657 (1982).

28. Ion-exchange High Performance Liquid Chromatography of Oligodeoxyribonucleotides using Formamide.
C.R. Newton, A.R. Greene, G.R. Heathcliffe, T.C. Atkinson, D. Holland, A.F. Markham and M.D. Edge.
Analytical Biochemistry, 129, 22-30 (1983).

29. Isolation and DNA sequence of a full length cDNA clone for human X-chromosome encoded phosphoglycerate kinase.
A.M. Michelson, A.F. Markham and S.H. Orkin.
Proc. Natl. Acad. Sci. USA, 80, 472-476 (1983).

30. Anti-Oxazolone Hybridomas and the Structure of the Oxazolone Idiotype.
M. Kaartinen, G.M. Griffiths, P.H. Hamlyn, A.F. Markham, K. Karjalainen, J.L.T. Pelkonen, O. Makela and C. Milstein.
J. Immunology, 130, 937-945 (1983).

31. Direct detection of the common Mediterranean β-Thalassemia gene with synthetic DNA Probes; an alternative approach for prenatal diagnosis.
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